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~~SECRET~~ P. 12

FOUR GIANTS of the LEWIS RESEARCH CENTER

by Robert W. Graham

~~REFERENCE COPY~~ OCT 29 1991



Dr. George W. Lewis



Dr. Hugh L. Dryden



Dr. Edward R. Sharp



Abe Silverstein

(NASA-TM-83642) FOUR GIANTS OF THE
LEWIS RESEARCH CENTER (NASA) 12 p

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FOUR GIANTS

of the LEWIS RESEARCH CENTER

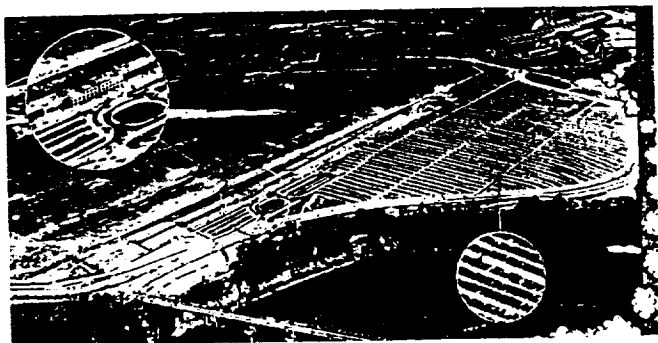
Robert W. Graham

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Lewis Research Center
Cleveland, Ohio 44135*

May 1984

History is fascinating to read. But when one witnesses that history, it takes on a new dimension of excitement and authenticity. Such has been my privilege at my place of employment—the NASA Lewis Research Center.

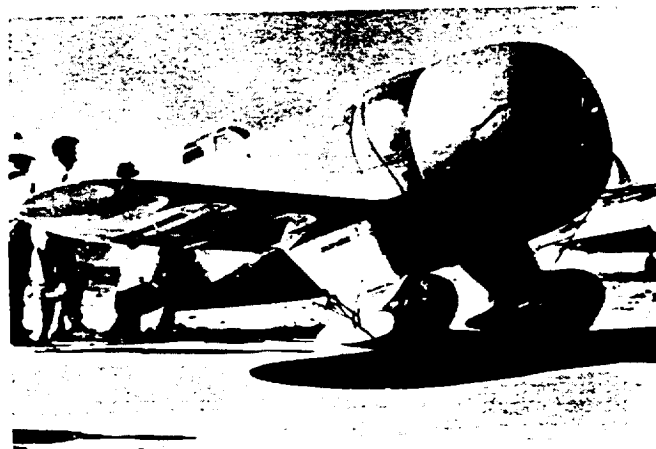
Actually, my involvement and recollections go back more than a decade before the Center was started. The land presently occupied by Lewis Research Center was once the site of the huge parking lot and grandstands for the world-famous National Air Races held in Cleveland beginning in 1929 and continuing throughout the 1930's.



Site of the National Air Races at the Cleveland Airport.



Charles A. Lindbergh and the Spirit of St. Louis at the Cleveland Airport.



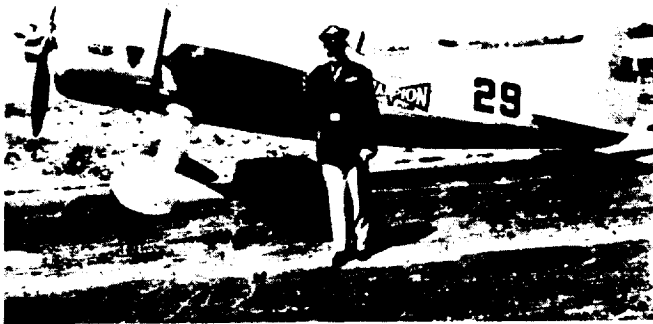
Jimmy Doolittle's GB Special.

For a Cleveland boy fascinated by aviation, the annual Labor Day pilgrimage to the Air Races was the highlight of the year.

I remember such notable flyers as Lindbergh, Doolittle, Turner, Hughes, Earhart, Williams, and Whitman. In 1933, I recall seeing a sleek Wedell-Williams



Frederick Crawford and James Doolittle.



Roscoe Turner and the Laird Special racer.

Special exceed 300 mph as a new speed record for a land-based airplane.

It seems particularly fitting that the site of the National Air Races became the location selected for the NACA Aircraft Engine Research Laboratory, which eventually became the Lewis Research Center. This article focuses on four outstanding leaders who have influenced the history of the Lewis Research Center, and I have been fortunate to know all but one of them.



A Wedell-Williams racing plane and its pilot, James R. Wedell.

George William Lewis

George William Lewis was born in Ithica, New York, in 1882. He attended Cornell University and graduated with a degree in Mechanical Engineering in 1908. He remained at Cornell 2 more years to receive his Master's Degree. He then joined the faculty of Swarthmore College in Philadelphia.

After industrial experience with the Clark Thompson

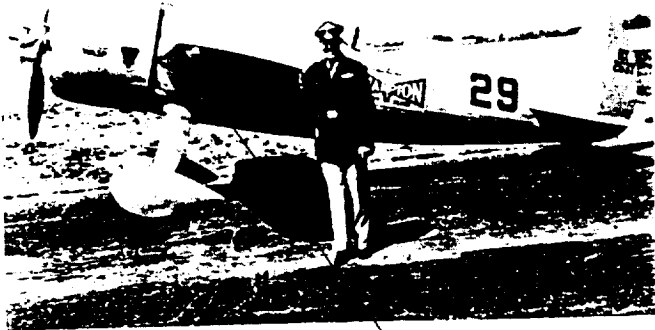
Research Company in Philadelphia, he was appointed the Chief Executive Officer of the newly formed National Advisory Committee for Aeronautics (NACA) in 1919. NACA was formed during World War I by an Act of Congress which established a volunteer committee to advise the Nation in the progress of aviation. The agency had a very small beginning during World War I when the Army loaned a hangar and two airplanes for some flight test work at Langley Field, Virginia.



Dr. George W. Lewis.

In 1919 when George Lewis assumed the position of Executive Officer of NACA, he had 20 employees and a very modest laboratory at Langley Field. However, in his staff were several very brilliant, young engineers including Edward Warner, Frederick Norton, and an engineering test pilot by the name of Edmund Allen. These three men made significant contributions to early aviation in this country. By training, George Lewis was a mechanical engineer and did not have much background in the new emerging engineering area called aeronautics. (No one did.) However, he recognized that the unpredictable performance of airplanes could only be remedied when a thorough understanding of aerodynamics was developed. In particular, the relation between the means of propulsion and the flight characteristics of the airplane had to be established.

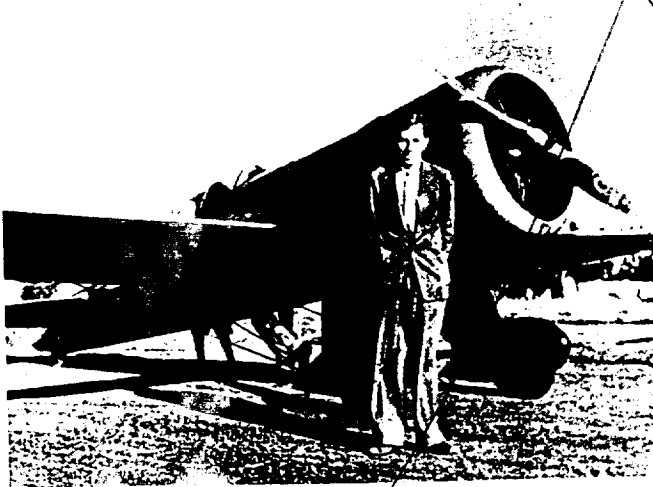
It can be said that his entire career was devoted, in essence, to building a scientific basis for aeronautical engineering. As this new branch of engineering advanced, largely through his efforts, he was able to secure more adequate equipment for measurement, larger and faster



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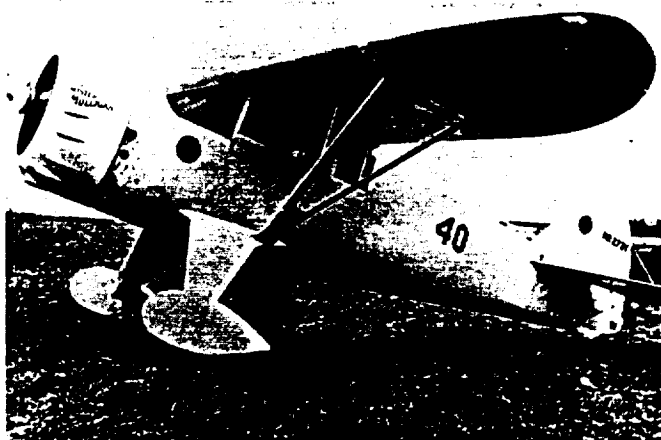


Groundbreaking 1941 (left to right, William R. Hopkins, Major John Berry, Frederick C. Crawford, General George H. Brett, Dr. Edward Warner, Captain Sidney Kraus, Mayor Edward Blythin, and Dr. George W. Lewis).

wind tunnels, and special wind tunnels to study the many aspects of aeronautical engineering problems. Under his guidance the relatively small NACA stationed at Langley Field, Virginia, was expanded to other laboratories in the country. First, a laboratory at Moffett Field, California, called the Ames Laboratory, and finally, a third laboratory at Cleveland, Ohio, which was devoted exclusively to flight propulsion. In the development of these new laboratories, George Lewis insisted that each one have a flight test division. "In order," as he would say, "to study the scientific problem of flight with a view to practical solution." (This quotation is from the enabling legislation for NACA.)

While Dr. Lewis was Director of Research for NACA, there were several developments that he must personally be credited for in terms of the accomplishment that came out of this organization. In the early 1930's, the radial air-cooled engine was adopted for most airplanes, but it was handicapped by excessive air drag due to the exposure of the cylinders of the engine to the airstream. Through the effort of a team of researchers at Langley, a cowl was developed which covered the engine in such a manner that only the air necessary for cooling the engine went into the mouth of that cowl and across the cylinders while the majority of the air on the outside passed over the streamlined surface of the cowl. This development resulted in the dramatic reduction of engine drag. Another practical development which was based on NACA research was the flapped wing. The flapped wing, as we know today, has enabled both improved landing and takeoff characteristics of the airplane. The development of the flap was accompanied by the design

of the tricycle-type landing gear which prevented some of the hazardous noseovers that were common in the landing of aircraft. The flight proof of these three developments, the cowled engine cover, the flaps for wings, and the tricycle landing gear, was accomplished in extensive research and flight test programs under NACA.



Engine of this racer was streamlined with a cowl. This plane won the 1935 Thompson Trophy Race.

Dr. Lewis took personal interest in these developments. I never had the pleasure of meeting or knowing Dr. Lewis. He died, apparently from overwork, in 1948 just before I joined the Flight Propulsion Laboratory. In recognition of his great contribution to NACA and to aviation in this country and throughout the world, the Flight Propulsion Laboratory at Cleveland now bears his name. Two of his



May 8, 1942, initiation of research at the Aircraft Engine Research Laboratory (left to right, Ernest G. Whitney, Carlton Kemper, E. H. Chamberlin, Dr. George W. Lewis, John F. Victory, Edward R. Sharp, and H. J. E. Reid).

sons did work at the Lewis Research Center, and I had the privilege of being in the same organization for a number of years with George W. Lewis, Jr. His son attested to his father's openmindedness. He never condemned anyone for proposing new ideas. He encouraged the pioneers in rocketry to pursue their ideas even though there was not wide acceptance of their concepts at the time.



Dr. Lewis looks on as Willson Hunter explains propeller research to General Arnold.



Dr. Lewis and Dr. Sharp address the NACA employees, May 8, 1942.

Dr. Lewis was a close friend of Charles Lindbergh, and they shared common views on the progress of world aviation. Both were alarmed by the military advances in Nazi Germany during the 1930's. Lindbergh chaired the special committee that recommended to Congress that an aircraft engine laboratory be started.

Dr. Lewis was a brilliant engineer who had great organizational capabilities and great personal warmth and charm, which endeared him to all who worked with

him. The loyalty of those who worked intimately with him contributed greatly to the formation of NACA and the laboratories he founded.

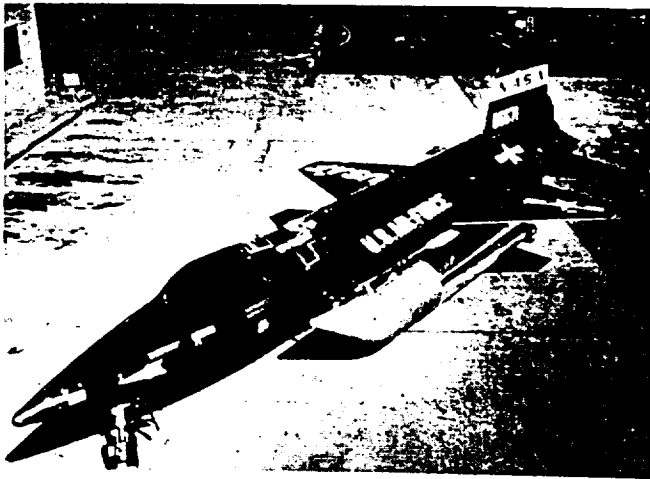
Hugh Latimer Dryden

The second giant who contributed much to the history of the Lewis Research Center is Hugh Latimer Dryden. He was a native of Maryland and earned his Bachelor of Arts and Doctor of Philosophy degrees at the Johns Hopkins University. He received his doctorate in physics before he was 21. Throughout his academic career, he was identified as an unusually brilliant scholar. And this scholarship was characteristic of his entire professional career.



Dr. Hugh L. Dryden.

Immediately after leaving the Johns Hopkins University he was named Chief of the Aerodynamics Section of the Bureau of Standards where he embarked on a series of pioneering research experiments in high-speed aerodynamics. These achievements won him international recognition as a scientist. Within 4 years he became the first researcher to take aerodynamic data at near the sonic velocity. He continued some of his pioneering research in the study of turbulence and boundary layer control. This research contributed much to the understanding of the frictional flow of fluids over wings or other aerodynamic shapes, and it advanced the



X-15 experimental rocket-propelled aircraft.

science of aeronautics significantly during the 1920's. His work continues to be referenced by those who are doing research in turbulence and boundary layers today.

Dr. Dryden became the Assistant Director of the National Bureau of Standards in 1946, and then in just a few months he became its Associate Director. In 1947 he left the Bureau Standards to become the Director of Aeronautical Research for the National Advisory Committee for Aeronautics. In 1949 Dr. Dryden was appointed Director of NACA, the highest position in the government agency. One of the programs started under his direction was the X-15 rocket propelled airplane, which proved to be the most advanced aircraft ever flown. It provided flight experience at speeds in excess of six times the speed of sound and at altitudes approximating 70 miles.



President Eisenhower commissions Dr. Glennan and Dr. Dryden as Administrator and Deputy Administrator of NASA, respectively.

In 1958 the National Aeronautics and Space Act was signed and the National Advisory Committee for Aeronautics became a part of the National Aeronautics and Space Administration (NASA). Dr. Hugh Dryden was named Deputy Administrator of this newly formed agency. In the early days of NASA he was a dominant leader in the manned space flight program from Project Mercury to Apollo.

In 1960, my wife and I had the pleasure of entertaining Dr. Dryden in our home for a few days while he participated in a conference ("Conversations About the Ethical Use of Knowledge") at Baldwin-Wallace College in Berea, Ohio. Dr. Dryden was the principal resource person in the area of space exploration. In the concluding paragraphs of his prepared remarks, he said the following:

How can space technology be channeled into peaceful efforts for enterprises? It is necessary to choose suitable objectives of research, development and application widely supported by public opinion throughout the world. The sharing of benefits with other nations and the free dissemination of the information obtained, established in this area as in others, is a suitable atmosphere for the promotion of peace. Support of the efforts of the international scientific organizations and of the agencies of the United Nations represents a fruitful avenue to the desired goal. When each of us faces the complexity of the problem of the ethical use of scientific knowledge, he begins to doubt his power to make a contribution to its solution. I can only say that one must place his faith in the combined power of many individuals who sincerely strive to use their talents and the opportunities provided by their jobs to become channels through which the highest moral aspirations and ideals of man may be realized to the greatest possible extent.

Those of us at the Lewis Center who knew and worked with Dr. Dryden while he was Director of NACA or Deputy Administrator of NASA will remember a kindly, soft-spoken man, who was devoted to the peaceful uses of science. His example for scientific brilliance and for personal integrity remains with us as an inspiration.

Edward R. Sharp

The third giant to influence the history of the Lewis Research Center was Edward R. Sharp. A native of Virginia, he began his professional career as an officer in the United States Navy. He served from 1914 to 1919 and retired with a reserve commission as a Lieutenant



Dr. Edward R. Sharp.

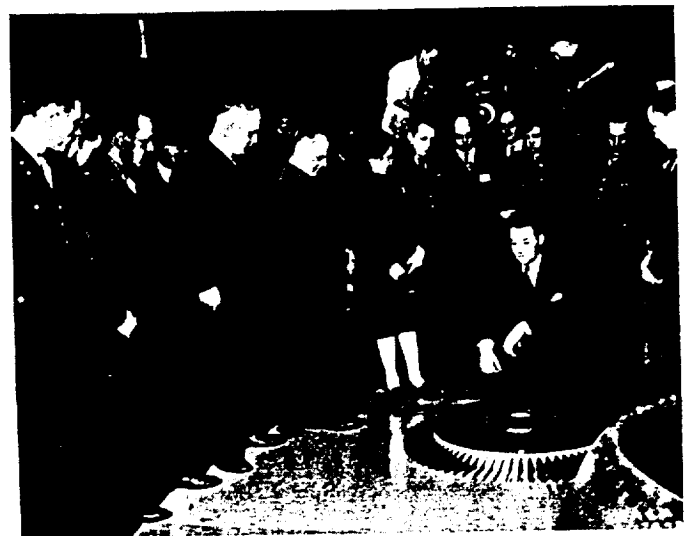
Commander. He joined the National Advisory Committee for Aeronautics in February 1922 as its 54th employee. Edward R. Sharp, known as Ray Sharp, was not a technical man by training. He was educated as a lawyer at William and Mary College. As an employee of NACA he was assigned to the Langley Laboratory in Virginia, and in a short time he became Chief Administrative Officer, which made him the second in command of the Laboratory. He served in that position from 1925 to 1940.

In the early 1940's when NACA was expanding, Ray Sharp was sent to Moffett Field, California, to supervise the building program of the new Ames Aeronautical Laboratory. He spent about a year in California before being called back to Langley Field, Virginia, to initiate plans for a new laboratory to be built in Cleveland, Ohio. He came to Cleveland in 1941 and was appointed construction manager of the new Aircraft Engine Research Laboratory. He served as the first manager of the Laboratory when it began operations in 1942. In 1947, his title was changed to Director of the Flight Propulsion Laboratory, which became the Lewis Flight Propulsion Laboratory in 1948.

Ray Sharp established an enviable record as a builder of NACA laboratories. He was a large man, imposing and handsome in appearance. He spoke with a deep, soft Virginia drawl, and he was admired and well-liked by the entire staff while he served as the Lewis Director. He had particularly strong ties to the technicians and craftsmen of the Laboratory and was extremely proud of their accomplishments. During his tenure as Director of Lewis,

he instituted a strong apprentice program and, although that program is not as large as it once was, it is still active at the Center in training technicians in many areas of mechanical, electronic, and electrical support.

As mentioned earlier, Edward R. Sharp was not an engineer by training. Nevertheless, he soon acquired a technical reputation as an authority on aviation facilities and testing. For that reputation he received many technical honors. He was elected President of the Institute of Aeronautical Sciences, and he was a member of the Association for the Advancement of Science. In 1947 he received the U.S. Medal of Merit, which was presented on behalf of President Truman. In the 1940's he received two honorary doctorate degrees from engineering schools. His talent was not limited to the administration of the Lewis Research Center. He served



Willson Hunter describes a gas turbine to General Doolittle and Dr. Sharp.



Dr. Silverstein, Dr. Sharp, the Duke of Windsor, and Mr. Manganiello.



Dr. Silverstein, Dr. Sharp, and the Duke of Windsor.



Left to right, John Victory (Secretary of NACA), Dwight Eisenhower, Edward R. Sharp, and Mayor Thomas Burke.

the City of Cleveland in many volunteer ways, including the American Red Cross, the Mayor's Airport and Harbor Commission, the Chamber of Commerce, and the Community Fund. He retired as Director of Lewis in 1961.

Dr. Sharp will always be remembered for his outstanding efforts in establishing two of the NACA, now NASA, Centers—Ames and Lewis. He was an effective administrator, and he had the capability to train and assign people to specific tasks in the technical area. He was extremely proud of the Lewis Research Center and its staff, and he enjoyed the friendship and admiration of that staff throughout the time he was associated with the Center. He would frequently leave his desk in the Administration Building and journey into the shops and the laboratories of the Center and show his

interests in what each individual was doing. He also enjoyed showing "the Lab" to visiting dignitaries from home and abroad. In my own contact with him, I can remember trying to get authority to hire a person who was not yet a citizen of this country but had a particular talent in an area of heat transfer that we wanted at the Center. And I can remember how he persisted with the Department of State and NASA Headquarters in getting the necessary approvals, one of which was from Dr. Dryden, in order to hire this individual. Dr. Sharp's widow still lives in Lakewood, Ohio, and is an infrequent visitor to the Lewis Research Center. One of their sons, Bob, worked with me at the Center for approximately a year and a half. He was an outstanding young researcher and is now a professor at the University of Michigan.

Abe Silverstein

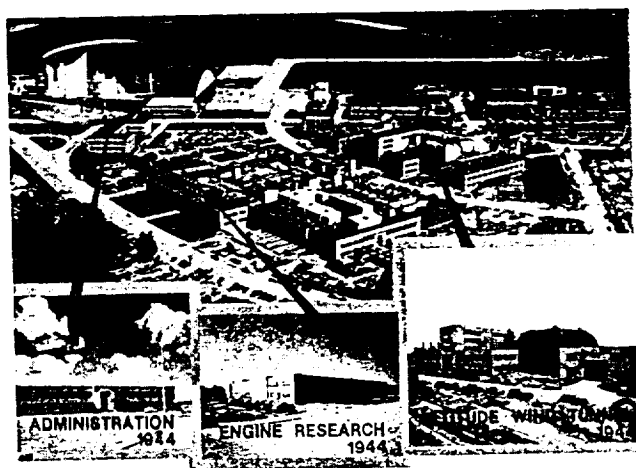
The fourth person in these sketches of significant personalities associated with the Lewis Research Center is Dr. Abe Silverstein, a native of Terre Haute, Indiana. He is the only one of these four men who is still living. He and his wife are residents of Fairview Park, Ohio.



Dr. Abe Silverstein.

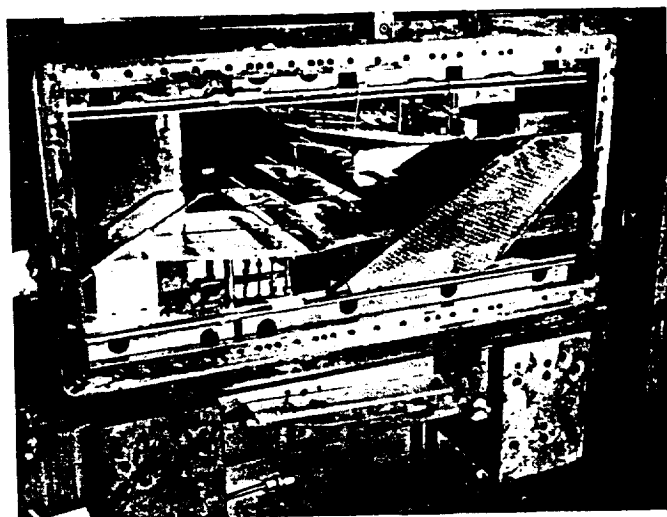
Abe Silverstein joined the National Advisory Committee for Aeronautics in 1929 after graduating from Rose Polytechnic Institute in Indiana, which is now called the Rose-Holman Institute. His first NACA

assignment was at the Langley Center where he designed the first full-scale wind tunnel installed at that laboratory. Using this new tunnel, he was in charge of conducting research which had a marked effect of the aerodynamic design of World War II aircraft. In 1943 Dr. Silverstein was transferred to the Cleveland Laboratory as Chief of the Wind Tunnel and Flight Division with responsibility for the first major facility, the Altitude Wind Tunnel, at the Lewis Center. This tunnel, which was designed expressly for some propulsion and engine problems, was large enough to house a full-scale engine, the cowling, and the integration of the engine into the wing or airframe. One of the first research tasks performed in the facility was a study of how to improve the cooling of the engine in the B-29. This was a high priority project carried out near the close of World War II. You probably are aware that the B-29 was the bomber which was designated for the raids over Japan, and it was a B-29 that carried the first atomic bomb.



Construction in the 1940's.

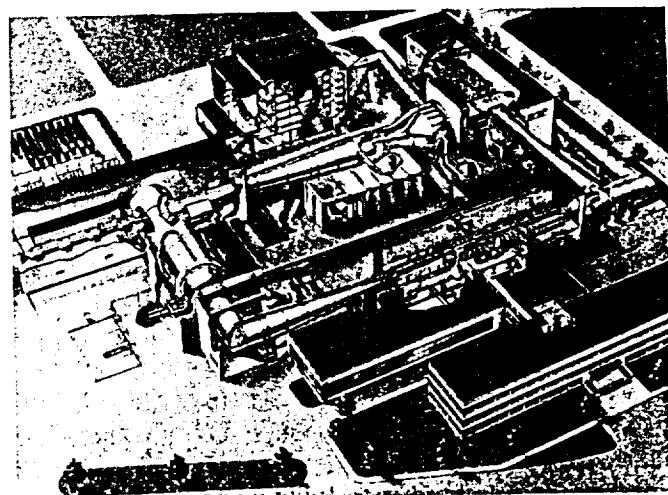
The Altitude Wind Tunnel was also used in some of the earliest tests of the new concepts of the turbojet engine and the ramjet. Dr. Silverstein was in charge of that pioneer research. After World War II, he continued as Chief of the Wind Tunnel and Flight Division at Lewis and directed the propulsion research toward the growing interest in high-speed flight. The possibility of cracking the sonic barrier was considered to be one of the major aerodynamic challenges of the time. Dr. Silverstein was responsible for the conception, design, and construction of the Nation's first supersonic wind tunnels devoted to propulsion research. One of the small prototype supersonic tunnels that he used in the development of the larger tunnels is still being used effectively in some research programs, although it is now about 40 years old. There are two major supersonic propulsion tunnels at



Duct Lab prototype supersonic tunnel.

Lewis—the 8 by 6 and the 10 by 10. These dimensions (in feet) prescribe the area of the tunnel throat where the supersonic velocities are experienced. The large 10 by 10 tunnel can be used for speeds of approximately three times the velocity of sound. These tunnels have been in use for more than 30 years. Dr. Silverstein can claim credit for their installation at the Lewis Research Center.

In 1949 Dr. Silverstein was made Chief of all the research work at Lewis, and in 1952 he was named Associate Director. Shortly after the conversion of Lewis from an NACA Center to a NASA Center, Dr. Dryden, who was the new Associate Administrator of NASA, asked Abe Silverstein to come to Washington to head the Office of Space Flight Programs. Under his supervision, the earliest space probes and man-in-space program were initiated. He was the early architect of the Moon landing project and gave it the name Apollo. Following the retirement of Dr. Edward R. Sharp in 1961, Dr.



10- by 10-Foot Supersonic Wind Tunnel at Lewis Research Center.

Silverstein returned to Lewis to become its second Director. He continued as Center Director until his retirement in 1969.

Dr. Silverstein is an exceptionally talented engineer with an uncanny grasp for the details of research programs and with an extraordinary memory of the information on those programs. I have been embarrassed by his memory capabilities on several occasions. In making research reviews to him, I discovered that he remembered some information that I had given him in previous reviews with greater precision than I did. Dr. Silverstein directed Lewis during its most active years when NASA was a growing organization. The current capabilities of the Center are in large part the result of his effective leadership in research during the 1940's, 1950's, and 1960's. Although retired, his wisdom is still sought by the management of the Center, and he frequently appears as a consultant at the Lewis Research Center.

Concluding Remarks

These sketches are the result of the research I did for talks presented in the Cleveland community about the history of Lewis Research Center. This research uncovered some interesting information and photographs and rekindled some personal memories. For me it was an inspiring experience to investigate and recall experiences of the past associated with these four giants. I am indebted to George W. Lewis, Jr., for supplying information about his father, and also to Mike Kusenda for pictures of the National Air Races.

Indeed, history is a fascinating, living subject, and I am glad I could share some of it that has significance to Cleveland and the surrounding communities.

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